DOCUMENT RESUME

ED 078 093 TM 002 913

AUTHOR	Levin, Henry M.
TITLE	The Economic Implications of Mastery Learning. Occasional Papers in the Economics and Politics of Education.
INSTITUTION	Stanford Univ., Calif. School of Education.
REPORT NO	Occas-Pap-73-5
PUB DATE	May 73
NOTE	25p.; Paper presented at symposium of annual meeting of American Educational Research Association (New Orleans, Louisiana, February 25-March 1, 1973)
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Academic Achievement; Cognitive Processes; Costs; *Economic Factors; *Evaluation Techniques; *Learning Processes; *Social Change; Standards; Teaching Methods
IDENTIFIERS	*Mastery Learning

ABSTRACT

An internal/external efficiency evaluation on the economic implications of mastery learning is presented. Two important aspects of mastery learning are: (1) its intrinsic worth regardless of economic benefits, and (2) the necessary changes in the social and economic structure that will make the mastery learning approach increasingly functional. It is pointed out that the mastery learning approach has a very humane quality in its concern with equalizing outcomes. There are important societal changes in the offing that will increase the functionality of this approach. It is concluded that the economic importance of the mastery-learning strategy will rise substantially over the foreseeable future. (Author/CK)

FILMED FROM BEST AVAILABLE COPY

ED 078093

TM 002 913

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED 078093

THE ECONOMIC IMPLICATIONS OF MASTERY LEARNING

Henry M. Levin

Occasional Paper 73-5
May, 1973

Occasional Papers in the Economics and Politics of Education

School of Education
Stanford University

Presented at the Symposium on Schools, Society and Mastery Learning, March 28, 1973 at the 1973 Annual Meeting of the American Educational Research Association, New Orleans.

I - INTRODUCTION

Any attempt to describe the economic implications of mastery learning is necessarily audacious. Since its initial formulation by Bloom in the late sixties based upon the work of Carroll, it has stimulated a wide variety of applications, and the individual projects and programs that are linked by the mastery learning banner are so diverse that they defy easy generalization.[1] Moreover, little attention has been devoted to costs or other types of data that might represent the basis for economic evaluation. Given the lack of a data base and the diversity of applications, one is handicapped in making any generalizable assertions about the economic implications of mastery learning. Accordingly, it is necessary to proceed by making a number of assumptions about the nature, processes, and outcomes of the mastery-learning approach. To the degree that the reader disagrees with these assumptions, he is also likely to question the subsequent analysis.

In this commentary I will view mastery learning as an instructional strategy that is characterized by the following traits: First, it is presumed that learning tasks are related to specific and unambiguous goals, and that success in achieving these goals can be assessed adequately by a criterion-based test. Second, it is assumed that it is possible for a legitimately constituted group of decision-makers to select the "mastery-level of attainment" in such a way that this level

of attainment is indicative of functional competence in the specific area of concern. Third, the vast majority of students can attain mastery, so-defined, if enough time is permitted for achieving it. Fourth, the objective of the mastery-learning strategy is to maximize the number of students achieving mastery subject to the overall constraints on the magnitude of resources and the aggregate amount of time; but there will be no constraints on the distribution of time and resources among students within those aggregates. Finally, the principal educational treatments that will be utilized to achieve this objective are the differentiation of instruction according to learner aptitudes and the sequential allocation of resources from those students who have achieved mastery to those who have not. The process continues until all students have achieved mastery or until the aggregate time boundaries allocated to the learning task are exceeded. The aim of both the learner-differentiated instruction and the assignment of resources to those who need them most is to reduce the time differential between the fastest and slowest learners for attaining mastery.

There are several aspects of the mastery-learning approach that make it particularly amenable to economic evaluation. For any particular task one should be able to observe specific outcomes as well as measures of time and resource allocations. Moreover, the strategy has an explicit theoretical model underlying it so that data can be interpreted within the structure of that paradigm. Finally, the mastery-learning technique is concerned as much with equality of

results as it is with the level of cognitive proficiency. Thus, both the outcome and its distribution among students are taken into account. All of these characteristics make the mastery-learning approach considerably more susceptible to economic analysis than traditional modes of educational organization since the latter are usually characterized by vague objectives, ambiguous theories and inadequately-elaborated instructional processes.

Economic Criteria

There are two general guidelines for examining the economic implications of an educational strategy. The first type of evaluation addresses the internal efficiency of the approach with regard to its cost-effectiveness at producing a given result.[2] A specific method is considered to be efficient according to "internal" criteria if it is able to attain a given set of educational goals at lower cost than other alternatives.

The criterion of external efficiency considers not only the costs relative to results, but also the value to society of the results. Attempts are made to estimate the monetary value of both the costs and the benefits in order to compare that ratio with the costs and benefits of other educational approaches as well as with investments in areas of social concern outside of the educational arena.[3] In order for a strategy to satisfy the criterion of external efficiency, it must provide at least as great a social benefit per unit of cost as other social investments.

While the evaluation of internal efficiency is devoted only to ascertaining the costs of a specific outcome--for example, 80 percent of students attaining mastery--, the evaluation of external efficiency requires that the outcome itself has high benefits relative to its costs. In summary, comparisons of internal efficiency are essentially comparisons of the costs for attaining a given result; in contrast, comparisons of external efficiency require the assessment of both the costs and social benefits that might emanate from a given activity.[4]

According to both internal and external efficiency criteria, it is difficult to make empirically-based statements about the relative economic efficiency of mastery-learning. The reason for this lack is two-fold. First, mastery-learning has different goals than traditional instruction, so it is not possible to compare the costs of attaining the same result. Second, there do not exist adequate cost data from either conventional instruction or mastery-learning that enable one to attempt even a rough comparison of efficiency. Accordingly, the remainder of this analysis will attempt to develop the economic implications of mastery-learning by analyzing the cost aspects and benefit aspects of the technique. In some cases we will be able to draw comparative inferences on the economic properties of mastery-learning, and in other cases we will not.

II - INTERNAL EFFICIENCY OF MASTERY-LEARNING

According to advocates of mastery-learning, the approach can increase the average level of knowledge for a particular group of students while simultaneously reducing the variance within the group.[5] If we can assume that both increases in cognitive attainments and greater equality in their distribution are of positive value, and this can be done within the same time and resource constraint as for the conventional framework, then the mastery technique is superior to the traditional organization on grounds of internal efficiency. That is, more can be accomplished by applying resources through mastery learning than through the traditional approach. But, we have no supporting experimental or quasi-experimental evidence at this time since most of the testing of mastery techniques has taken place outside of the economic framework.[6] Yet, the various components of the mastery "technology" can be scrutinized in order to observe their cost implications with regard to a given outcome.

There are at least four aspects of mastery learning that appear to be related to the internal efficiency question: 1) learner-differentiated treatments; 2) sequential transfer of resources from students who have attained mastery to those who have not; 3) coordination of curriculum and mastery attainments so that students are prepared for successive levels of instruction; and 4) possible changes in the affective outcomes of schooling. Each of these will be reviewed briefly, and the nature of their effects on the relationship of costs to outcomes will be examined. In all four cases we

will be assuming that the criterion of effectiveness will be the number of students achieving mastery at each level.

The use of learner-differentiated instructional treatments would seem intuitively to improve the internal efficiency of the schools. That is, if resources can be reorganized in such a way as to capitalize on the different aptitudes of students, it seems plausible that learning outcomes will improve.[7] Certainly, there is a strong conceptual basis for this expected outcome on the "aptitude-treatment-interaction" literature. The principle underlying this approach is that different students enter the classroom situation with different aptitudes for learning particular material, and instructional treatments should be differentiated to capitalize on such differences in aptitudes.

What is unrecognized in this argument is that while learner-differentiated instruction may produce gains in the number of children achieving mastery, such an approach has added costs as well (relative to traditional instructional approaches). These costs are of three types: diagnosis and screening, allocating fixed costs of treatments over fewer students, and lost time in moving from treatment to treatment.

The diagnosis and screening requirements for identifying students with different aptitudes and determining the appropriate instructional treatments are likely to be substantial. Information that is obtained on an individual student basis for each learning task is exceedingly costly, and the knowledge of instructional treatments

consonant with aptitude classifications is speculative at best.[8] To the degree that a substantial number of learning-related aptitudes exist among a typical group of students, the cost problem is compounded. Both costs and probable results rise with the number of aptitude-treatment classifications that are implemented, but it is likely that the additional costs exceed the gains beyond a relatively small number of aptitude differentiations.[9] It is important to note that the cost of obtaining information on student differences and appropriate instructional approaches can be substantial, even in the two-aptitude case, especially when aptitudes and treatments are not generalizable across subject areas.

A closely related area of added cost is that each treatment will be divided over fewer students under a learner-differentiated approach. To the degree that instructional treatments have fixed costs, the allocation of such costs to fewer students means a higher per-pupil cost. Indeed, to the degree that there will be fixed staffing requirements for each instructional treatment--regardless of the number of students involved--learner-differentiated approaches will require a greater expenditure on personnel. This assumption is particularly warranted if we assume that the different instructional approaches must be applied concurrently in order to minimize the aggregate amount of time allocated to the task.

Finally, that portion of learner-differentiated instruction that uses the same personnel and physical resources for each instructional group faces a loss in efficiency and time in the shift from one group

to another. There are two reasons for such a loss. First, the physical movement of groups and personnel take time, but more important is the loss of continuity as resources are shifted around from group to group. One of the important gains from specialization of function is that which is attributable to continuity of task in contrast to the shift from one task to the next. This assertion would seem equally valid in the classroom.

In summary, there appear to be both added cognitive gains and costs to utilizing the learner-differentiated approach. It would appear that cognitive gains would emerge from designing instruction to capitalize on differences in aptitudes, but such a policy would also entail the added costs of diagnosis and screening, fewer students per treatment, and loss of resource efficiency in moving among instructional tasks. Without a data base and a specific task it is impossible to set out the conditions under which the costs of learner-differentiated instruction would be justified by results, so it is not possible to determine <u>a priori</u> whether this aspect of mastery-learning will improve the efficiency of educational resource use.

In contrast, a second aspect of mastery learning would appear to improve the internal efficiency of resource application in the schools. This aspect is the sequential transfer of resources from students who have attained mastery to those who have not. In the traditional classroom, students who have mastered the subject matter are exposed to the same instructional treatments as those who have not. Such an approach has two negative consequences with regard to the effective use of edu-

cational resources. First, it wastes resources by subjecting students who have already mastered material to redundant exercises. This repetition may also have the effect of oppressing and "turning off" those students. Second, it does not give the students who have not yet achieved mastery the benefit of concentrated resources. By shifting resources sequentially from those students who have achieved mastery to those who have not, the faster students can be encouraged to inquire into enrichment areas which would not otherwise be covered, and the slower pupils will benefit from an increasingly higher concentration of resources assisting them as the other students attain mastery. Such an approach also enables the quicker students to tutor the slower ones in order to assist the latter group to attain mastery.[10]

A third aspect of the mastery learning approach is also likely to increase the internal efficiency of the educational enterprise. Since mastery learning seeks to maximize the number of students attaining mastery of a given task, successful results mean that a higher proportion of students will be ready for the subsequent learning task. Under the present normative-based approach, it is expected that a substantial number of students will not succeed. As the curriculum progresses to more difficult material, these students find themselves farther and farther behind until "contact" is lost completely. By ensuring that a maximum number of students achieve mastery at each level, a maximum number will be ready to move to the next level. This aspect of the mastery approach has important implications for increasing resource effectiveness.

A final aspect of the mastery-learning approach that has implications for internal efficiency is that which deals with the affective outcomes of instruction. According to Benjamin Bloom and James Block, preliminary data suggest that mastery approaches have noticeable positive effects on students' interest and attitudes.[11] Not only are improvements in such outcomes as students' attitudes about their capabilities and interest in their studies valuable on their own merits, but such affective improvements are likely also to contribute to cognitive gains. While the present data are not adequate to assert that mastery learning generally produces better affective outcomes than traditional instruction, it seems reasonable that this might occur because of the emphasis on maximizing the number of students who achieve mastery rather than utilizing the normative-based treadmill where only the "leaders" can feel confident of their success.[12]

Summary of Internal Efficiency

Given the criterion of the number of children achieving mastery as the measure of effectiveness, there appear to be several ways in which the internal efficiency of schools might be increased through mastery learning. The first of these, learner-differentiated instruction, is likely to improve learning outcomes, but it is not likely that this strategy can be attempted without an increase in resource costs. Whether these additional costs are offset by the larger number of children who attain mastery is problematic. Specific empirical data are needed in order to evaluate the issue, and such data are not presently available.

The effects of other aspects of the mastery approach on internal economic efficiency are less ambiguous. These include the sequential transfer of resources from students who have attained mastery to those who have not (including the use of student tutors); the coordination of curriculum and mastery attainments so that students are prepared for successive levels of instruction; and possible improvements in the affective outcomes of schooling. To the degree that these can be derived independent of the learner-differentiated instruction, they do not imply higher costs, and they would appear to increase the number of students attaining mastery.

The preceeding discussion was based completely on conceptual differences between traditional modes of instruction and mastery approaches. The lack of cost-effectiveness data on all types of instruction prevents any further generalization. Also, any specific application of any particular mode of instruction may vary so much from setting to setting that any generalization is hazardous at best. Given these cautions, however, I suspect that empirical data will show that mastery learning approaches are somewhat more efficient relative to costs in increasing cognitive attainments and reducing the variance in results when compared with more traditional instructional approaches. I doubt that the differences in relative efficiency are dramatic since there are many other factors influencing both the level and distribution of cognitive outcomes that are quite independent of the organization of formal instructional activities.

III - EXTERNAL EFFICIENCY OF MASTERY-LEARNING

In order to ascertain the relative external efficiency of mastery-learning, we must consider the relative social benefits as well as the costs of the approach. While a study of internal efficiency might just review the costs and cognitive effectiveness of different approaches, the evaluation of external efficiency requires that these effects be translated into measurable social benefits for comparison with costs and benefits from other types of social investments. In theory, then, we would be able to compare investments in traditional instruction and mastery with investments in health, highways, welfare, recreation, and so on in order to see which one yields the largest returns to society for each additional dollar of expenditure.[13]

Obviously, if we do not have adequate data on comparisons of internal efficiency questions, we are even more handicapped with regard to our evaluation of external efficiency. Yet, it is still possible to examine the possible sources of improvement in educational effectiveness in order to see how these might translate into social benefits. In doing so, it is best to start off with the most optimistic assumptions about the internal efficiency of mastery-learning and to proceed from there. Accordingly, we will assume that mastery-learning will raise the average level of cognitive attainments for any group of students while simultaneously reducing the cognitive variance or inequality among those students. We must now ask how these effects will be converted into social benefits.

It is, of course, appealing to believe that increases in the level of and improvements in the distribution of cognitive proficiencies will lead to improvements in the amounts and distribution of social attainments. For example, the literature on human capital would suggest that improvements in skill levels as reflected in mastery attainments might raise social productivity and income as well as upgrade occupational attainments.[14] Moreover, it might be assumed that by reducing the disparity in cognitive accomplishments among students, there will also be a corresponding reduction in inequality of income and occupational status. Such theories assume tacitly that: 1) income and occupational attainments are determined primarily by cognitive proficiencies; and 2) that educational reform leads to social reform.

Each of these assumptions must be questioned. That is, there is very little empirical evidence to support the view that cognitive proficiencies are an important determinant of income and earnings or occupational status, and there is no body of evidence that supports the proposition that educational reform leads to social reform. In the first case, an increasing body of literature is emerging which relates test scores, socio-economic background, educational attainments, and a host of social-psychological variables to earnings and occupational status. The somewhat surprising result in virtually all of these studies is the exceedingly modest relationship between cognitive proficiencies measured by standardized test scores and measures of earnings and occupational status.[15] Indeed, recent excursions into the

relations between education, occupation, and income have found increasing evidence of the role played by non-cognitive outcomes in both the educational and mobility processes. Accordingly, there is no assurance, given the present social and economic structure of society, that improvements in the level of and distribution of cognitive outcomes will change substantially the nature of social outcomes.

The important point is that the schools correspond to their host society in that they fulfill the requirements for socializing persons for adult roles.[16] In a society that is characterized by substantial inequalities in adult roles, the schools will function purposively to socialize differentially the population to fill the occupational and income hierarchy.[17] Thus, it is hardly a mindless endeavor of the schools to sort, stratify, and track youngsters in such a way that at the end of the process their places in the hierarchy of production are legitimated and certified.[18] That is, the reproduction of the social relations of production is an important function of the schools, and schools will continue to show unequal results as long as there exist large inequalities in the production, occupational, and earnings hierarchy.[19]

Without changes in the nature of production and its accompanying social relations, any strategy that will more nearly equalize cognitive outcomes will have little effect on the distribution of opportunity since the opportunities themselves are so unequal. There are only a limited number of rewards at each level in the existing social structure, and there is neither a conceptual nor an empirical tie between more equal cognitive outcomes and greater social equality.

The crux of the matter is that the fairness or social justice inherent in the mastery learning concept is not reflected in a corresponding set of social institutions. To go somewhat farther, this lack of correspondence would tend to support the following predictions: 1) The mastery learning strategy will not be adopted in any systematic sense; or 2) if adopted, the outcomes for which mastery learning will be implemented will not be important ones with regard to the social selection process. That is, if mastery learning is successful in being adopted and in more nearly equalizing certain educational outcomes, the outcomes themselves will lack importance with regard to the social process of selecting individuals for filling roles within the occupational and income hierarchy. Cognitive characteristics which the schools equalize will not be functional traits for the allocation of the very unequal set of social rewards, and schools will continue to differentiate their students on important dimensions of the social selection process.

IV - SUMMARY OF ECONOMIC IMPLICATIONS OF MASTERY LEARNING

The economic evaluation of mastery learning can be carried out at two levels, internal and external. According to the internal efficiency criterion, there are a number of characteristics of the mastery learning strategy that suggest that it might obtain better cognitive outcomes relative to costs than traditional methods of instruction. In contrast, it was argued that according to the external efficiency criterion the mastery learning strategy did not seem to have an advantage. The greater equality of cognitive outcomes is not likely to

change the distribution of social outcomes such as the distribution of earnings and the occupational structure. Moreover, it was asserted that even changes in the overall level of cognitive performance are not likely to be reflected in significant increases in aggregate productivity and earnings.

What we have not examined are two aspects of mastery learning that are probably far more important in the long run than the narrow questions raised by economic efficiency criteria in the present context. First, is there anything intrinsically worthwhile about mastery learning that is desirable regardless of its economic benefits? And second, are there changes in the social and economic structure that will make the mastery learning approach increasingly functional? In my view the answers to both of these questions are yes.

The mastery learning approach has a very humane quality in its concern with equalizing outcomes. Although the term equality resounds throughout the philosophical literature on American education, I would maintain that the traditional educational strategy is designed to deliberately separate and differentiate students by performance rather than to equalize them. School organizations devote an enormous amount of energy to testing, grouping, curriculum, and counseling practices that are designed inherently to sort and socialize children differentially. Although these procedures are rationalized educationally on the most pious of grounds, they serve to cull out systematically the children from poorer backgrounds. The existent system of financing education also discriminates systematically

against the poor.[20] It is precisely the contradiction to this programmed inequality that represents both the strengths and weaknesses of mastery learning. The concern of the mastery learning conception with equality and fairness in the achievement of educational outcomes is worthy of great praise. Paradoxically, this virtue is also its achilles heel since such values are not implicit in the social, political, and economic organization of the larger society.

More optimistically, there are important societal changes in the offing that will increase the functionality of the mastery learning approach even though at the present time it is contradicted by the larger set of social institutions. The present system of production in both the public and private sectors is becoming beset increasingly by events which threaten to create severe disruptions. As a recent report produced by the U. S. Department of Health, Education and Welfare emphasized, the increasing alienation of the American worker with the circumstances of his job is responsible for rising incidences of wildcat strikes, alcoholism and drug problems on the job, breakdowns in quality control, worker turnover and absenteeism, and employee sabotage.[21] In order to safeguard production and the control of capital, business firms and government agencies are seeking ways to reorganize work in order to decrease worker alienation and increase worker loyalty.

While there are many different forms of changes in work organization, all of them attempt to reduce the alienation and dissatisfaction

of workers while increasing productivity by changing the nature of workers' relationships to the firm, to fellow workers, and to the decision-making mechanisms.[22] Some approaches would allow workers to organize into production teams that would rotate specific jobs, set production schedules, and monitor quality control functions. Other proposals would replace hierarchical lines of authority and bureaucratic organization with worker self-management. This broad family of alternatives can be thought of as attempts to increase the degree of "industrial democracy." Recent experiments in the United States and abroad suggest that this phenomenon will become increasingly important as a strategy for improving worker satisfaction while reducing the threat of disruptions.

If these predicted changes take place, then mastery learning will become increasingly functional to the training of workers. Under most proposals for reorganizing work, there would be a much greater emphasis on cooperation and on the universal mastery of particular skills so that workers could rotate jobs and share particular duties. In order to satisfy these needs, an educational strategy that attempts to bring all persons up to requisite levels of mastery is needed. Although the mastery approach does not correspond to the demands of the present production organizations, it does fulfill many of the educational requirements that will be demanded by proposed changes. Accordingly, I expect that the economic importance of the mastery-learning strategy will rise substantially over the foreseeable future.

FOOTNOTES

1 - B. S. Bloom (1968); J. B. Carroll (1963); For a review of mastery learning developments and research see J. H. Block (1971) and (1973).

2 - For an introduction to the application of these techniques to educational decision-making see J. A. Thomas (1971).

3 - A good example of such an attempt is found in T. I. Ribich (1968).

4 - A summary of efficiency concepts in education is found in H. M. Levin (1971).

5 - See J. H. Block (1971), pp. 2-12.

6 - The exceptions are N. O. Christoffersson (1971) and W. T. Garner (1973) who view mastery learning with regard to the economics of time. However, they do not consider the human and physical resources that enter the educational process.

7 - See L. J. Cronbach and R. E. Snow (1969).

8 - A theoretical base on the economics of information is found in George Stigler (1961). Heuristic issues on the costs of additional testing versus its utility are found in L. J. Cronbach and G. C. Gleser (1965).

9 - See L. J. Cronbach and G. C. Gleser (1965) for a similar problem regarding the use of tests for personnel selection.

10 - This is an advantage which is difficult to implement in the conventional classroom setting with its teacher-dominated approach.

11 - B. S. Bloom (1971) and J. H. Block (1973).

12 - See the summary in J. H. Block (1973), pp. 38-41.

13 - A survey of cost-benefit literature is found in A. R. Prest and R. Turvey (1965).

14 - G. S. Becker (1964).

15 - See for example the recent studies of Z. Griliches and W. Mason (1972); P. J. Taubman and T. J. Wales (1973); and S. Bowles and H. Gintis (1973).

16 - This thesis is demonstrated eloquently in A. Inkeles (1966).

17 - See the discussion in H. Gintis (1972); S. Bowles (1972); and H. M. Levin (1973).

18 - Such characteristics of schools are discussed in R. Dreeben (1968), and their links to production are reviewed in H. Gintis (1971) and S. Bowles (1972).

19 - See L. Althusser (1971); S. Bowles (1972); H. M. Levin (1973); and M. Carnoy (1972).

20 - See J. Coons et. al. (1970).

21 - Work in America (1973).

22 - See C. Pateman (1970) and G. Hunnius et. al. (1973).

BIBLIOGRAPHY

Althusser, Louis, Lenin and Philosophy and Other Essays (New York, London: Monthly Review Press, 1971), pp. 127-186.

Becker, Gary S., Human Capital (New York: Columbia University Press, 1964).

Block, James H., "Mastery Learning in the Classroom: An Overview of Recent Research," (1973), mimeo.

Block, James H. (ed.) Mastery Learning: Theory and Practice (New York: Holt, Rinehart, and Winston, 1971).

Bloom, Benjamin S., "Affective Consequences of School Achievement," in Mastery Learning: Theory and Practice, James H. Block (ed.) (New York: Holt, Rinehart, and Winston, 1971).

Bloom, Benjamin S., "Learning for Mastery," Evaluation Comment, Vol. 1, No. 2 (1968).

Bowles, Samuel, "Unequal Education and the Reproduction of the Social Division of Labor" in Martin Carnoy (ed.), Schooling in a Corporate Society, (New York: David Mc Kay Company, Inc., 1972).

Bowles, Samuel and Herbert Gintis, "IQ in the U.S. Class Structure," Social Policy (Jan./Feb. 1973).

Carnoy, Martin (ed.), Schooling in a Corporate Society (New York: David Mc Kay Co., Inc., 1972).

Carroll, John B., "A Model of School Learning," Teachers College Record, Vol. 64 (1963), pp. 723-733.

Christoffersson, N. O., The Economics of Time in Learning, Special Topic Bulletin No. 34, Department of Educational and Psychological Research, School of Education (Malmo, Sweden; November, 1971).

Coons, John E., William H. Clune III, and Stephan D. Sugarman, Private Wealth and Public Education, Belknap Press (Cambridge, Mass: Harvard University Press, 1970).

Cronbach, Lee J. and Goldine C. Gleser, Psychological Tests and Personnel Decisions (Chicago: Illini Books, 1965).

Cronbach, L. J. and R. E. Snow, Individual Differences in Learning Ability as a Function of Instructional Variables, Final Report, U.S. Office of Education, OEC 4-6-061269-1217 (Bethesda, Md.: ERIC Documentation Reproduction Service, 1969).

Dreeben, Robert, On What is Learned in School (Reading, Mass.: Addison Wesley and Co., 1968).

Garner, William T., "The Identification of An Educational Production Function by Experimental Means," Presented at the Annual Meetings of the American Educational Research Association, New Orleans (February 1973), mimeo.

Gintis, Herbert, "Education, Technology and the Characteristics of Worker Productivity," American Economic Review, Vol. LXI, No. 2 (May 1971), pp. 266-279.

Gintis, Herbert, "Toward a Political Economy of Education," Harvard Educational Review, Vol. 42, No. 1 (Feb. 1972), pp. 70-96.

Griliches, Z. and W. Mason, "Education, Income, and Ability," Journal of Political Economy, Supplement (May/June 1972).

Hunnius, Gerry, David Garson, John Case (ed.) Workers' Control: A Reader on Labor and Social Change (New York: Vintage, 1973).

Inkeles, Alex, "The Socialization of Competence," Harvard Educational Review, Vol. 36, No. 3 (Summer 1966), pp. 265-283.

Levin, Henry M., "Educational Reform: Its Meaning?", Paper Presented at Conference on "The Public Interest in Education: Toward a Policy for the United States," sponsored by the Center for the Study of Democratic Institutions (Santa Barbara: March 19, 20, 1973). Available as Occasional Papers in the Economics and Politics of Education, 73-1, School of Education, Stanford University.

Levin, Henry M., "The Effect of Different Levels of Expenditure on Educational Output," in R. L. Johns et. al., Economic Factors Affecting the Financing of Education (Gainesville, Florida: National Educational Finance Project, 1971), Chapter 6.

Pateman, Carole, Participation and Democratic Theory (New York: Cambridge University Press, 1970).

Prest, A. R. and R. Turvey, "Cost-Benefit Analysis: A Survey," Economic Journal, Vol. 75 (December 1965), pp. 683-735.

Ribich, Thomas I., Education and Poverty (Washington, D.C.: The Brookings Institution, 1968).

Stigler, George J., "The Economics of Information," Journal of Political Economy (June, 1961).

Taubman, Paul J. and Terence J. Wales, "Higher Education, Mental Ability, and Screening," Journal of Political Economy, Vol. 81, No. 1 (January/February 1973), pp. 28-55.

Thomas, J. Alan, The Productive School (New York: John Wiley & Sons, Inc., 1971).

Work in America, Report of a Special Task Force to the Secretary of Health, Education, and Welfare (Cambridge, Mass: The MIT Press, 1973).